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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/661,466	09/11/2003	Franco Vitaliano	VXM-001B	7136
7590	05/31/2006		EXAMINER	
FRANCO AND GORDANA 4 LONGFELLOW PLACE #2105 BOSTON, MA 02114			NEGIN, RUSSELL SCOTT	
			ART UNIT	PAPER NUMBER
			1631	

DATE MAILED: 05/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>
	10/661,466	VITALIANO ET AL.
	<b>Examiner</b>	<b>Art Unit</b>
	Russell S. Negin	1631

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 24 April 2006.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-29,33-37,41,44 and 46-68 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-29,33-37,41,44 and 46-68 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All    b) Some \* c) None of:
  1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date: _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>7/21/04</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|  | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### ***Comments***

The cancellation of claims 30-32, 38-40, 42-43, and 45 are acknowledged.

### ***Claim Rejections - 35 USC § 101***

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-16, 19-30, 35, 36, 41, 44, 46-49, 51-63, and 66-68 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 1-16, 19-30, 36, 37, 42, 45, 47-49, 51-63, and 66-68, as written, do not sufficiently distinguish over molecules which act as quantum information processing platforms comprising elements as they exist naturally because the claims do not particularly point out any non-naturally occurring differences between the claimed products and the naturally occurring products. In the absence of the hand of man, the naturally occurring products are considered non-statutory subject matter. See *Diamond v. Chakrabarty*, 447 U.S. 303, 206 USPQ 193 (1980). The claims should be amended to indicate the hand of the inventor, e.g., by insertion of "Isolated" or "Purified" as taught in the specification on page 3. See MPEP 2105.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 64 and 65 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 64 and 65 claim “the quantum information processing element of claim 1...” wherein claim 1 is a quantum information processing platform. Thus, ambiguity exists as to whether a quantum processing element of a quantum processing platform is described in claims 64 and 65.

Claim 23 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 23 equates one or more cargo elements with a plurality of cargo elements. A plurality means greater than one, so it is ambiguous as to how a single cargo element can represent a plurality of cargo elements.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-16, 19-30, 35, 36, 41, 44, 46-49, 51-58, 62-63, and 66-68 are rejected under 35 U.S.C. 102(b) as being anticipated by Gelderblom [AIDS, 1991, volume 5, pages 617-637].

Claims 1-16, 19-30, 35, 36, 41, 44, 46-49, 51-58, 62-63, and 66-68 state:

1. A quantum information processing platform comprising, a plurality of quantum information processing elements each having, a cage defining a cavity formed from a plurality of self-assembling protein molecules, and one or more cargo elements located within the cavity, wherein at least one of the cargo elements comprises a qubit programmable into a plurality of logical states.
2. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, receptors for capturing and positioning the one or more cargo elements within the cavity.
3. A quantum information processing platform according to claim 2, wherein the quantum information processing elements comprise, a vesicle located within the cage and enclosing the one or more cargo elements, wherein the receptors extend through the vesicle to capture and position the cargo element within the vesicle.
4. A quantum information processing platform according to claim 3, wherein the quantum information processing elements comprise, adaptors disposed between the receptors and the cage and binding to the receptors.
5. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, a vesicle located within the cage and enclosing one or more cargo elements.
6. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, molecular tethers for capturing and positioning one or more cargo elements within and or outside the cavity.
7. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, direct cage bonding for capturing and positioning one or more cargo elements within and or outside the cavity.
8. A quantum information processing platform according to claim 1, wherein the

quantum information processing element comprise, receptors, molecular tethers and direct cage bonding for capturing and positioning one or more cargo elements within and or outside the cavity.

9. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements further comprises a non-permeable cavity.

10. A quantum information processing platform according to claim 3, wherein the one or more vesicles of a subset of the quantum information processing elements further comprises a non-permeable cavity.

11. A quantum information processing platform according to claim 1, wherein the cage is electrically neutral and inhibits charge transfer between the cage and its cargo elements.

12. A quantum information processing platform according to claim 1, wherein the cage reduces the tendency of a plurality of logical states in a coherent state to collapse into a decoherent state.

13. A quantum information processing platform according to claim 1, wherein the cage inhibits non-quantum information processing cargo elements from interfering with qubit cargo element operation in other cages.

14. A quantum information processing platform according to claim 3, wherein the vesicle is electrically neutral and inhibits charge transfer between the vesicle and its enclosed cargo elements.

15. A quantum information processing platform according to claim 3, wherein the vesicle is insulative and reduces the tendency of a plurality of logical states in a coherent state to collapse into a decoherent state.

16. A quantum information processing platform according to claim 4, wherein the receptors and adaptors are electrically neutral and inhibit charge transfer between the vesicle and cage and their cargo elements.

19. A quantum information processing platform according to claim 1, comprising a self-assembling framework of cages to structurally support one or more of the self-assembling quantum information processing elements.

20. A quantum information processing platform according to claim 1, comprising a self-assembling electrically neutral substrate of cages to structurally support one or more of the self-assembling quantum information processing elements.

21. A quantum information processing platform according to claim 1, comprising a self-assembling framework of cages to structurally order one or more self-aligning ones of the quantum information processing elements.
22. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements is a single cargo element comprising a qubit programmable into a plurality of logical states.
23. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements are a plurality of cargo elements.
24. A quantum information processing platform according to claim 23, wherein the plurality of cargo elements are qubits programmable into a plurality of logical states.
25. A quantum information processing platform according to claim 23, wherein at least some of the plurality of cargo elements are non-quantum information processing cargo elements.
26. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements respond to stimuli internal and or external to the cage.
27. A quantum information processing platform according to claim 3, wherein the one or more vesicles of a subset of the quantum information processing elements respond to stimuli internal and or external to the vesicle.
28. A quantum information processing platform according to claim 1, wherein the one or more quantum information processing elements and their qubit and non-QIP cargo are used in vitro and or in vivo.
29. A quantum information processing platform according to claim 23, wherein a subset of the non-quantum information processing cargo elements include one or more single task and or multitask in vivo and or in vitro agents.
35. A quantum information processing platform according to claim 23, wherein a subset of the cargo elements include one or more liquids without dopants or with one or more dopants of any type.
36. A quantum information processing platform according to claim 23, wherein a subset of the qubit and non-quantum information processing cargo elements include a gas or vapor without dopants or with one or more dopants of any type.
37. A quantum information processing platform according to claim 1, wherein the at

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least one qubit of a subset of the plurality of quantum information processing elements are programmed by one or more pulses of electromagnetic radiation.

41. A quantum information processing platform according to claim 1, wherein the at least one qubit of a subset of the quantum information processing elements and the plurality of logical states of the qubit are defined by one or more properties and or attributes.

44. A quantum information processing platform according to claim 1, wherein the at least one qubit of a subset of the quantum information processing elements includes one or more species of molecules.

46. A quantum information processing platform according to claim 1, wherein at least one qubit of a subset of the quantum information processing elements includes a qubit that is photon-based and the plurality of logical states of the photon-based qubit includes a coherent logical state.

47. A quantum information processing platform according to claim 1, wherein the plurality of logical states includes a coherent state.

48. A quantum information processing platform according to claim 1, wherein the plurality of logical states includes a coherent state at room temperature.

49. A quantum information processing platform according to claim 1, wherein the cage bioengineered in whole or in part.

51. A quantum information processing platform according to claim 1, wherein the cage comprises self-assembling synthetic protein molecules.

52. A quantum information processing platform according to claim 4, wherein receptors, adaptors, and vesicle comprise natural and or synthetic protein molecules.

53. A quantum information processing platform according to claim 4, wherein the receptors, adaptors, and vesicle are bioengineered in whole or in part.

54. A quantum information processing platform according to claim 1, wherein at least a portion of the cage is coated in one or more materials.

55. A quantum information processing platform according to claim 4, wherein at least a portion of the receptors, adaptors, and vesicle is coated in one or more materials.

56. A quantum information processing platform according to claim 1, wherein the cage is substantially greater than one nanometer in diameter.

57. A quantum information processing platform according to claim 1, wherein the cage is at least about 50 nanometers in diameter.

58. A quantum information processing platform according to claim 1, wherein the cage is at least about 100 nanometers in diameter.

62. A quantum information processing platform according to claim 1, wherein a subset of the quantum information processing elements are physically linked together.

63. A quantum information processing platform according to claim 1, wherein a subset of the quantum information processing elements are functionally linked together, locally and or at a distance.

66. A quantum information processing platform according to claim 1, wherein a subset of the quantum information processing elements form a hybrid system upon their physical and or functional integration with non-invention elements in vitro and in vivo.

67. A method for a quantum information processing platform comprising, providing one or more quantum information processing elements, each quantum information processing element comprising a cage defining a cavity formed from a plurality of self-assembling protein molecules, and one or more cargo elements located within the cavity, wherein, at least one of the cargo elements comprises a qubit programmable into a plurality of logical states; programming the one or more quantum information processing elements using an encoder; and reading information from the one or more quantum information processing elements using a decoder.

68. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, a functionalized cage for attaching one or more elements external to the cage.

The platform, element, and method mapped out in the base claims of the instant application (claims 1 and 64), describe a human immunodeficiency virus (HIV). Figure 3 on page 620 of Gelderblom diagrams the HIV-1 virus. The HIV-1 virus is a cage of self-assembling proteins (i.e. Figure 2 on page 619) defining a cavity, wherein at least one of the cargo elements comprises a qubit programmable into a plurality of logical states. Since a virus holds nucleic acids, and each atom and/or molecule of nucleic acid can be considered a qubit based on its electron spin (i.e. every molecule, no matter

how large has a wave function), HIV-1 Virus fits the description of the QIP platform and element stated in the base claim.

It is evident from Figure 3 of Gelderblom that the schematic has receptors useful for positioning the contents of the virus. The interior of the virus forms a vesicle through which the receptors extend. “Adaptors” also exist in the diagram. This vesicle is located within the protein “cage” and encloses one or more cargo elements. The receptors are interpreted to act as tethers for capturing and infecting biological objects outside the virus. In addition, the contents of the virus have the capability of directly bonding to the interior of the protein cage. The QIP element as shown in Figure 3 is non-permeable and has a non-permeable vesicle to shield outside molecules. The QIP element (or in this case virus) is electrostatically neutral at a single value of pH; when solution conditions are adjusted to this value of pH, charge transfer is inhibited. As illustrated in Figure 2, the HIV-1 virus is self-assembling- at the isoelectric pH, charge transfer between viruses, receptors, and adaptors is inhibited.

In the case of an empty virus (no cargo elements), the cage comprises a non-qubit only cage. Viruses together as shown in Figure 2 of Gelderblom comprise a self-assembling framework of cages to structurally support one or more self assembling QIP elements. At the isoelectric pH, these frameworks of cages are electrostatically neutral. The framework of cages can align the structural elements within each virus.

Viruses respond to stimuli external to the virus itself (i.e. the method in which HIV is spread). The nucleic acids inside the virus are considered multitask in vitro agents. It is inherent that an atom on at least one molecule of the nucleic acid has an unpaired

electron used to define the qubit by electron spin polarization. The nucleic acid is also a plurality of QIP elements physically linked together. The virus encloses a plurality of different molecules and is self-assembled. In vivo viruses are in aqueous solution, so they are enclosed and coated with water molecules. Figure 1 of Gelderblom illustrates that HIV-1 viruses are greater than 100 nanometers in diameter.

It is inherent, that when investigated on an atomic level, the nucleic acids atoms form coherent states that collapse into a decoherent state in the classical limit of the entire virus.

Claims 1-16, 19-30, 35, 36, 41, 44, 46-49, 51-63, and 66-68 are rejected under 35 U.S.C. 102(b) as being anticipated by Stewart et al. [Current Topics in Microbiology and Immunology, 1995, volume 199, pages 25-38].

Claims 1-16, 19-30, 35, 36, 41, 44, 46-49, 51-63, and 66-68 state:

1. A quantum information processing platform comprising, a plurality of quantum information processing elements each having, a cage defining a cavity formed from a plurality of self-assembling protein molecules, and one or more cargo elements located within the cavity, wherein at least one of the cargo elements comprises a qubit programmable into a plurality of logical states.
2. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, receptors for capturing and positioning the one or more cargo elements within the cavity.
3. A quantum information processing platform according to claim 2, wherein the quantum information processing elements comprise, a vesicle located within the cage and enclosing the one or more cargo elements, wherein the receptors extend through the vesicle to capture and position the cargo element within the vesicle.
4. A quantum information processing platform according to claim 3, wherein the quantum information processing elements comprise, adaptors disposed between the receptors and the cage and binding to the receptors.
5. A quantum information processing platform according to claim 1, wherein the

quantum information processing elements comprise, a vesicle located within the cage and enclosing one or more cargo elements.

6. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, molecular tethers for capturing and positioning one or more cargo elements within and or outside the cavity.
7. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, direct cage bonding for capturing and positioning one or more cargo elements within and or outside the cavity.
8. A quantum information processing platform according to claim 1, wherein the quantum information processing element comprise, receptors, molecular tethers and direct cage bonding for capturing and positioning one or more cargo elements within and or outside the cavity.
9. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements further comprises a non-permeable cavity.
10. A quantum information processing platform according to claim 3, wherein the one or more vesicles of a subset of the quantum information processing elements further comprises a non-permeable cavity.
11. A quantum information processing platform according to claim 1, wherein the cage is electrically neutral and inhibits charge transfer between the cage and its cargo elements.
12. A quantum information processing platform according to claim 1, wherein the cage reduces the tendency of a plurality of logical states in a coherent state to collapse into a decoherent state.
13. A quantum information processing platform according to claim 1, wherein the cage inhibits non-quantum information processing cargo elements from interfering with qubit cargo element operation in other cages.
14. A quantum information processing platform according to claim 3, wherein the vesicle is electrically neutral and inhibits charge transfer between the vesicle and its enclosed cargo elements.
15. A quantum information processing platform according to claim 3, wherein the vesicle is insulative and reduces the tendency of a plurality of logical states in a coherent state to collapse into a decoherent state.

16. A quantum information processing platform according to claim 4, wherein the receptors and adaptors are electrically neutral and inhibit charge transfer between the vesicle and cage and their cargo elements.
19. A quantum information processing platform according to claim 1, comprising a self-assembling framework of cages to structurally support one or more of the self-assembling quantum information processing elements.
20. A quantum information processing platform according to claim 1, comprising a self-assembling electrically neutral substrate of cages to structurally support one or more of the self-assembling quantum information processing elements.
21. A quantum information processing platform according to claim 1, comprising a self-assembling framework of cages to structurally order one or more self-aligning ones of the quantum information processing elements.
22. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements is a single cargo element comprising a qubit programmable into a plurality of logical states.
23. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements are a plurality of cargo elements.
24. A quantum information processing platform according to claim 23, wherein the plurality of cargo elements are qubits programmable into a plurality of logical states.
25. A quantum information processing platform according to claim 23, wherein at least some of the plurality of cargo elements are non-quantum information processing cargo elements.
26. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements respond to stimuli internal and or external to the cage.
27. A quantum information processing platform according to claim 3, wherein the one or more vesicles of a subset of the quantum information processing elements respond to stimuli internal and or external to the vesicle.
28. A quantum information processing platform according to claim 1, wherein the one or more quantum information processing elements and their qubit and non-QIP cargo are used in vitro and or in vivo.
29. A quantum information processing platform according to claim 23, wherein a subset

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of the non-quantum information processing cargo elements include one or more single task and or multitask in vivo and or in vitro agents.

35. A quantum information processing platform according to claim 23, wherein a subset of the cargo elements include one or more liquids without dopants or with one or more dopants of any type.

36. A quantum information processing platform according to claim 23, wherein a subset of the qubit and non-quantum information processing cargo elements include a gas or vapor without dopants or with one or more dopants of any type.

37. A quantum information processing platform according to claim 1, wherein the at least one qubit of a subset of the plurality of quantum information processing elements are programmed by one or more pulses of electromagnetic radiation.

41. A quantum information processing platform according to claim 1, wherein the at least one qubit of a subset of the quantum information processing elements and the plurality of logical states of the qubit are defined by one or more properties and or attributes.

44. A quantum information processing platform according to claim 1, wherein the at least one qubit of a subset of the quantum information processing elements includes one or more species of molecules.

46. A quantum information processing platform according to claim 1, wherein at least one qubit of a subset of the quantum information processing elements includes a qubit that is photon-based and the plurality of logical states of the photon-based qubit includes a coherent logical state.

47. A quantum information processing platform according to claim 1, wherein the plurality of logical states includes a coherent state.

48. A quantum information processing platform according to claim 1, wherein the plurality of logical states includes a coherent state at room temperature.

49. A quantum information processing platform according to claim 1, wherein the cage bioengineered in whole or in part.

51. A quantum information processing platform according to claim 1, wherein the cage comprises self-assembling synthetic protein molecules.

52. A quantum information processing platform according to claim 4, wherein receptors, adaptors, and vesicle comprise natural and or synthetic protein molecules.

53. A quantum information processing platform according to claim 4, wherein the receptors, adaptors, and vesicle are bioengineered in whole or in part.
54. A quantum information processing platform according to claim 1, wherein at least a portion of the cage is coated in one or more materials.
55. A quantum information processing platform according to claim 4, wherein at least a portion of the receptors, adaptors, and vesicle is coated in one or more materials.
56. A quantum information processing platform according to claim 1, wherein the cage is substantially greater than one nanometer in diameter.
57. A quantum information processing platform according to claim 1, wherein the cage is at least about 50 nanometers in diameter.
58. A quantum information processing platform according to claim 1, wherein the cage is at least about 100 nanometers in diameter.
59. A quantum information processing platform according to claim 1, wherein the cage is symmetric with respect to a plane.
60. A quantum information processing platform element according to claim 1, wherein the cage has icosahedral geometry.
61. A quantum information processing platform according to claim 1, wherein at least one of the plurality of cages includes a plurality of qubits and a subset of the plurality of qubits are linearly positioned at vertices along a single plane using circulant ordering.
62. A quantum information processing platform according to claim 1, wherein a subset of the quantum information processing elements are physically linked together.
63. A quantum information processing platform according to claim 1, wherein a subset of the quantum information processing elements are functionally linked together, locally and or at a distance.
66. A quantum information processing platform according to claim 1, wherein a subset of the quantum information processing elements form a hybrid system upon their physical and or functional integration with non-invention elements *in vitro* and *in vivo*.
67. A method for a quantum information processing platform comprising, providing one or more quantum information processing elements, each quantum information processing element comprising a cage defining a cavity formed from a plurality of self-assembling protein molecules, and one or more cargo elements located within the cavity, wherein, at least one of the cargo elements comprises a qubit programmable into

a plurality of logical states; programming the one or more quantum information processing elements using an encoder; and reading information from the one or more quantum information processing elements using a decoder.

68. A quantum information processing platform according to claim 1, wherein the quantum information processing elements comprise, a functionalized cage for attaching one or more elements external to the cage.

The platform, element, and method mapped out in the base claims of the instant application (claims 1 and 64), describe an adenovirus. Figure 1 on page 26 of Stewart et al. diagrams the adenovirus. The adenovirus is a cage of self-assembling proteins defining a cavity, wherein at least one of the cargo elements comprises a qubit programmable into a plurality of logical states. Since a virus holds nucleic acids, and each atom and/or molecule of nucleic acid can be considered a qubit based on its electron spin (i.e. every molecule, no matter how large has a wave function), the adenovirus fits the description of the QIP platform and element stated in the base claim.

It is evident from Figure 1 of Stewart et al. that the schematic has receptors useful for positioning the contents of the virus. The interior of the virus forms a vesicle through which the receptors extend. "Adaptors" also exist in the diagram. This vesicle is located within the protein "cage" and encloses one or more cargo elements. The receptors are interpreted to act as tethers for capturing and infecting biological objects outside the virus. In addition, the contents of the virus have the capability of directly bonding to the interior of the protein cage. The QIP element as shown in Figure 1 is non-permeable and has a non-permeable vesicle to shield outside molecules. The QIP element (or in this case virus) is electrostatically neutral at a single value of pH; when

solution conditions are adjusted to this value of pH, charge transfer is inhibited. At the isoelectric pH, charge transfer between viruses, receptors, and adaptors is inhibited.

In the case of an empty virus (no cargo elements), the cage comprises a non-qubit only cage. Viruses together as shown in Figure 1 of Stewart et al. comprise a self-assembling framework of cages to structurally support one or more self assembling QIP elements. At the isoelectric pH, these frameworks of cages are electrostatically neutral. The framework of cages can align the structural elements within each virus.

Viruses respond to stimuli external to the virus itself (i.e. the method in which the adenovirus is spread). The nucleic acids inside the virus are considered multitask in vitro agents. It is inherent that an atom on at least one molecule of the nucleic acid has an unpaired electron used to define the qubit by electron spin polarization. The nucleic acid is also a plurality of QIP elements physically linked together. The virus encloses a plurality of different molecules and is self-assembled. In vivo viruses are in aqueous solution, so they are enclosed and coated with water molecules. Figure 3 of Stewart et al. illustrates that adenoviruses are greater than 100 nanometers in diameter.

Figure 3 of Stewart et al. illustrates that the adenovirus has icosahedral symmetry, and it is possible to position qubits symmetrically within the icosahedron. The icosahedral symmetry is symmetric with respect to several planes.

It is inherent, that when investigated on an atomic level, the nucleic acids atoms form coherent states that collapse into a decoherent state in the classical limit of the entire virus.

Claims 1, 3, 17, 18, 24, 33, 34, and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al. [Science, May 3, 2002; volume 296, pages 892-895] in light of Overman et al. [Biophysical Journal, volume 66, page A394, 1994, poster abstract].

Claims 1, 3, 17, 18, 23, 33, 34, and 37 state:

1. A quantum information processing platform comprising, a plurality of quantum information processing elements each having, a cage defining a cavity formed from a plurality of self-assembling protein molecules, and one or more cargo elements located within the cavity, wherein at least one of the cargo elements comprises a qubit programmable into a plurality of logical states.
3. A quantum information processing platform according to claim 2, wherein the quantum information processing elements comprise, a vesicle located within the cage and enclosing the one or more cargo elements, wherein the receptors extend through the vesicle to capture and position the cargo element within the vesicle.
17. A quantum information processing platform according to claim 1, wherein the cage reduces contaminant background radiation to cargo carried within the cage.
18. A quantum information processing platform according to claim 3, wherein the vesicle reduces contaminant background radiation to cargo carried within the vesicle.
23. A quantum information processing platform according to claim 1, wherein the one or more cargo elements of a subset of the quantum information processing elements are a plurality of cargo elements.
33. A quantum information processing platform according to claim 23, wherein a subset of the qubit and non-quantum information processing cargo elements include one or more quantum dots.
34. A quantum information processing platform according to claim 23, wherein a subset of the qubit and non-quantum information processing cargo elements include one or more photonic dots.
37. A quantum information processing platform according to claim 1, wherein the at least one qubit of a subset of the plurality of quantum information processing elements are programmed by one or more pulses of electromagnetic radiation.

In the article, "Ordering Quantum dots using genetically engineered viruses," Lee et al. describes genetically engineered crystals which incorporate zinc sulfide quantum dots. For example, column 3, of page 892, lines 4-9 state, "Here we report our first effort to direct multi-length scale ordering of quantum dot (QD) hybrid self-supporting biocomposite structures using genetically engineered M13 bacteriophage." A photonic dot is the microcavity that holds the quantum dots.

The last sentence of the abstract shows how the quantum dots are programmable by use of a magnetic field, "In addition, suspensions were prepared in which the lyotropic liquid crystalline phase behavior of the hybrid material was controlled by solvent concentration and by the use of a magnetic field." Thus, the virus affects the magnetic radiation experienced by the quantum dots.

It is inherent that the bacteriophage M13 virus is self assembling, as described in the abstract of Overman et al., entitled, "Raman spectroscopy of filamentous bacteriophage Ff (fd, f1, M13): Assignment and structural interpretation of coat protein aromatics," presented in a conference section entitled, "Folding and self-assembly IV: Spectroscopic and Methodological Studies," in which structural information of self assembled bacteriophage is obtained by Raman spectroscopy.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zampighi et al. [Journal of Structural Biology, volume 119, 1997, pages 347-359] in view of Greene et al. [Traffic, 2000, volume 1, pages 69-75].

Claims 1 and 50 state:

1. A quantum information processing platform comprising, a plurality of quantum information processing elements each having, a cage defining a cavity formed from a plurality of self-assembling protein molecules, and one or more cargo elements located within the cavity, wherein at least one of the cargo elements comprises a qubit programmable into a plurality of logical states.
50. A quantum information processing platform according to claim 1, wherein the self-assembling protein molecule is a clathrin molecule

The article of Zampighi et al. entitled, "Polyhedral protein cages encase synaptic

vesicles and participate in their attachment to the active zone," states in the fourth and fifth sentences of the abstract, "Type II synaptic vesicles were composed of a ~45-nm-diameter lipid bilayer sphere encased in a cage.... The cage was composed of open-faced pentamers 20-22 nm/side arranged as a regular polyhedron." The abstract continues, "Clathrin coated vesicles and pits... were also present in pre- and postsynaptic sides." Zampighi states in page 348 of the article, column 1, line 12 from the bottom, "Another type of vesicle, called type II, was composed of a lipid bilayer sphere encased in a polyhedral cage." The atoms on this lipid bilayer may act as a plurality of qubits. An example of an enclosed qubit is given in the specification on page 2 as an atom or molecule enclosed by a C<sub>60</sub> fullerene molecule; in this case the plurality of qubits lie along the lipid bilayer enclosed by the protein cage.

However, Zampighi does not teach self-assembling clathrin molecules.

As the title of he article of Greene et al. suggests, "Complete reconstruction of clathrin basket formation with recombinant protein fragments: adaptor control and clathrin self-assembly," clathrin molecules are used in self-assembly to form cages.

It would have been obvious for someone of ordinary skill in the art at the time of the instant invention to combine the teachings of Zampighi et al. and Greene et al. to result in the instantly claimed invention because while Zampighi et al teaches structure of the lipids in the protein cages, Greene et al. teaches analogous art for self assembling clathrins.

### ***Conclusion***

Art Unit: 1631

No claim is allowed.

Papers related to this application may be submitted to Technical Center 1600 by facsimile transmission. Papers should be faxed to Technical Center 1600 via the central PTO Fax Center. The faxing of such pages must conform with the notices published in the Official Gazette, 1096 OG 30 (November 15, 1988), 1156 OG 61 (November 16, 1993), and 1157 OG 94 (December 28, 1993)(See 37 CFR § 1.6(d)). The Central PTO Fax Center Number is (571) 273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Russell Negin, Ph.D., whose telephone number is (571) 272-1083. The examiner can normally be reached on Monday-Friday from 7am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's Supervisor, Andrew Wang, Supervisory Patent Examiner, can be reached at (571) 272-0811.

Any inquiry of a general nature or relating to the status of this application should be directed to Legal Instrument Examiner, Tina Plunkett, whose telephone number is (571) 272-0549.

Information regarding the status of the application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information on the PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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*John S. Brusca 28 May 2006*  
JOHN S. BRUSCA, PH.D  
PRIMARY EXAMINER